## 1. FPRS System

The free product recovery system (FPRS) was installed in the fall of 1994 and included four extraction wells/trenches. Within each trench was a recovery well, and two pumps were set inside each recovery well. The lower pump was intended to pump groundwater, with the goal of lowering the groundwater level in each of the extraction wells/trenches. The second pump within each extraction well was set at a higher elevation and was intended to recover light non-aqueous phase liquid (LNAPL) or oil that collected in the cone of depression caused by the groundwater draw-down.

The groundwater that was pumped from the extraction wells was injected to the subsurface through an infiltration trench north of the highway. There was no treatment of the GW prior to re-injection. Oil from the second set of pumps was collected in an above-ground storage tank (AST).

The system was operated from late 1994 until 2000, at which time it was shut down because it was not preventing the oil seeps in the river as intended. It was replaced with a containment barrier installed along the bank of the river in 2000.

## 2. GW Flow Directions and Hydraulic Control

In general, groundwater flow at the site has been estimated to be toward the southwest (Figure 1 from September 1994). However, while the FPRS was operating, Hart Crowser (Potlatch's consultant) measured and estimated changes in hydraulic gradients and contours caused by the operation of FPRS extraction well pumps. See Figure 2 from June 1995, which indicates a more southerly groundwater flow direction from the infiltration trench.

The location of the infiltration trench upgradient of the source area was intended to help remove LNAPL from the subsurface by using the injected water to push LNAPL towards the extraction trenches.

Potlatch's consultant Hart Crowser noted on several occasions (e.g., August 1997, April 1999) that the FPRS was not able to control groundwater at times depending on river conditions, which indicated that the system was not able to prevent discharges of oil to the river.

## 3. Upset Event

In the Spring of 1999, Potlatch reported an "upset event" in which oil was pumped through the groundwater pumps and was discharged into the infiltration trench north of the highway. From the April 28, 1999, Hart Crowser report:

> During weekly system monitoring done by Potlatch, free product was discovered in the ditch on the opposite side of the road. We planned to excavate the ditch to determine if the treatment system re-injection piping had a leak. On April 6, 1999. we excavated in the area of the re-injection trench and we discovered a significant amount of free product in the soil. While locating the injection piping we broke the pipe. We, therefore, could not tell if the pipe was already broken prior to our excavation. After repairing the pipe, the system was restarted. Once again, water was observed in the ditch about one week later. Other than residual free product in the ditch, no further free product has been observed since then. Absorbent booms have been placed in the ditch to catch any residual free product encountered.

> We have not been able to determine the source of the product in the soil above the re-injection piping. The source could be an unknown spill from the former storage tank that was located just up the hill. Another possibility is the treatment system water depression pumps are transferring free product from the extraction area to the re-injection area. To minimize the possibility of the total fluids pumps from transferring free product we reset the level control probes. This may reduce the system's ability to maintain groundwater capture. (Hart Crowser 1998)

Based on the location of the infiltration trench and the groundwater flow direction during the operation of the FPRS (Figure 2), Figure 3 shows the potential pathway of oil discharged from the infiltration trench north of the highway.

**4. Cross Section of Free Product Recover System**

Figure 4 shows a cross section of the site from the 1994 FPRS plans prepared by Hat Crowser on behalf of Potlatch and includes the relative elevation of the infiltration trench and the extraction trenches. This figure also indicates groundwater and surface water elevations in August 1989 and May 1990. Based on this cross section, the bottom of the infiltration trench north of the highway was located at an elevation that was approximately 5 to 10 feet higher than typical site groundwater elevations.

**5. 2000 LNAPL Plume Estimate**

The first known estimate of the extent of the LNAPL plume at the site was prepared by Hart Crowser for Potlatch based on test pits excavated in June 2000 (Figure 5). This 2000 plume estimate indicates that the northern boundary of the LNAPL plume is south of the highway, based on the observations of no visible free product in Test Pit 4. However, note that test pits were not excavated north of the highway.

Also, note that Hart Crowser did not leave a "monitoring well" (i.e., a slotted PVC pipe for future LNAPL and sheen monitoring) as they did with other test pits where free product was observed. It is not known to what degree the amount of oil discharged to the infiltration trench north of the highway may have migrated, and with no "monitoring well" at the Test Pit 4 location, no future data for that location south of the highway was recorded through subsequent monitoring.

Hart Crowser and Potlatch monitored the various site monitoring and extraction wells over time from 1994 through 2005. The monitoring data has been summarized in the attached spreadsheet (Table 1), and the maximum amount of product recorded in each well is indicated on Figure 5. The "monitoring wells" at test pit locations TP-3 and TP-5 are most directly south of the infiltration trench area, on the south side of the highway. In both of these wells, "sheen" was observed on the initial monitoring period in June 2000, while later, in 2001, monitoring indicated traces of oil in both.

**6. Changes to Plume Estimates over Time**

Over time, various investigators estimated the extent of the LNAPL plume area. These estimates are indicated on Figure 6, along with the excavation area from EPA's 2012 removal action (note: only on eastern half of the site; Potlatch completed the removal action on their western half of the site in 2013).

**7. Excavation of Oil-Contaminated Infiltration Trench, 2012**

During EPA's 2012 removal action, oil-contaminated soil was observed and removed from the area of the infiltration trench north of the highway.

## 8. Comparison of Quantity Estimates

The various LNAPL plume map estimates and the 2012 EPA excavation were digitized in GIS, and the areas of each are presented in Table 2. In particular, note how the estimated area has grown over time, and note the size of the 2012 excavation area compared to the earliest 2000 plume area estimate.